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CONSOLIDATED VULTEE AIRCRAFT CORP., FORT WORTH DIV., TEX
(REPORT FZR-36-239)

STATIC TEST PROPOSAL FOR SWEPT WING B-36 AIRPLANE

J.F. ROBINSON; GLENN W. ROBINSON 17 AUG'50 7PP DIAGRS

STRUCTURES (7)
TESTING (4)

WINGS - STRUCTURAL TESTING
WINGS, SWEPT
B-36

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CONVAIR ENGINEERING SECRET

~~SECRET~~

Classification Code and
Grouping to *Conf*
by *CD-356*
J. L. England

FT. WORTH DIVISION

TITLE

CHARTERED TEST PROGRAM FOR SHORT WING D-36 AIRPLANE



CONVAIR ENGINEERING SECRET

~~SECRET~~

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CONSOLIDATED VULTEE AIRCRAFT CORPORATION
FORT WORTH DIVISION • FORT WORTH 1, TEXAS

Consolidated Vultee Aircraft Corporation

FORT WORTH DIVISION
FORT WORTH, TEXAS

SCALE 1
REFERENCE FZ-36-232
MODEL Swept Wing B-36
DATE August 17, 1950

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SUBJECT: Static Test Proposal for Swept Wing B-36 Airplane.

DISCUSSION: By static testing the main structural components of the Swept Wing B-36 Airplane at this facility, the following time saving advantages would be realized:

1. The time that it would take to crate and prepare for shipment the main structural components to the Static Test Laboratory.
2. The shipping time between this facility and the Static Test Laboratory plus the time to uncrate the disassembled main structural components and reassemble them for static testing.
3. Additional time would be saved by this facility's being able to complete the design and construction of the test jigs and facilities prior to the receipt of the completed test specimen.
4. After structural failures occur, much time would be saved in making repairs by utilizing the engineering and shop personnel available at this facility. In addition, travel and living expenses of the personnel involved would also be saved.
5. The net effect of employing the above items will result in materially reducing the overall static test cost. In addition, it will also allow earliest possible incorporation of structural repairs and subsequently earlier completion date for both the prototype and production models.

PURPOSE: To prove the structural worthiness of the Swept Wing B-36 Airplane, the following major components will be static tested to their ultimate design loads and the tests continued to the failure of a primary structural member.

- A. Main Wing Box
- B. Aft Fuselage and Vertical Tail
- C. Bombardier's Enclosure

DESCRIPTION OF TEST SPECIMENS:

A. Main Wing Box

This specimen will consist of the full span main box (outer and inner panels) attached to and supported by a section of the fuselage from Station #6.0 to Station #8.0. The leading edges, trailing edges, nacelles, flaps and ailerons will not be included as part of the specimen.

B. Aft Fuselage and Vertical Tail

This specimen will consist of the fuselage, from Station #4.0 aft, the vertical tail and a section of the horizontal tail. A suitable portion of the wing center section from Station #5.0, left, to Station #5.0, right, will be included in the assembly to support and react the applied loads to the specimen.

C. Bombardier's Enclosure

This specimen will consist of the primary structure of the fuselage from Station #0 to 5" aft of Station #0.2.

CRITICAL LOAD CONDITIONS:

A. Main Wing Box

One condition of loading will be applied to the main wing box - that of positive low angle of attack.
(Ref: FZS-36-377)

Design Gross Weight = 410,000#
Load Factor = 3.0 (Ultimate)
Tip Deflection = 150" (Ultimate)

B. Aft Fuselage and Vertical Tail

Three conditions of loading will be applied separately to the aft fuselage: (Ref: FZS-36-377)

1. Side Load on Vertical Tail
2. L.A.A.
 - a. 1G balance plus Gust (and/or)
 - b. Accelerated Flight
3. Combined Vertical and Horizontal Tail Load

CRITICAL LOAD CONDITIONS: (continued)

C. Bombardier's Enclosure

The structure will be pressure tested to the design ultimate load and subsequently to failure.

GENERAL TEST SET-UP:

A. Main Wing Box

The main wing box specimen will be inverted and supported by the fuselage section attached to suitable jigs at the two bulkhead stations as shown in Figure 1. The critical "up" load will be applied by pulling down on the inverted wing.

B. Aft Fuselage and Vertical Tail

The specimen will be supported by the stub wing and a steel fixture at fuselage bulkhead #4.0 as shown in Figure 2. The stub wing, itself, will be attached to suitable steel fixtures at bulkheads #5.0, left and right.

C. Bombardier's Enclosure

The specimen will be attached to a steel plate and pressure tested.

DETERMINATION OF TEST LOADS - The test loads on both the wing and the fuselage for any given condition shall be applied in such a manner as to produce the same distribution of shear, moment, and torsion as calculated in the Stress Analysis Report FZS-36-377.

METHOD OF LOAD APPLICATION

A. Main Wing Box

The loads calculated as net air loads shall be applied with tension patches to the wing's upper surface and lead shot bags to the lower surface (side up) with proper distribution. Concentrated loads (net inertia loads) will in general be applied through suitable fixtures to the wing through the engine mount, landing gear attachments, etc. Additional concentrated loads will be applied to the bulkheads with contoured formers

A. Main Wing Box (Continued)

and rubber pads cemented to the outer surfaces to attain the correct design torsions, and to alleviate, at some stations, excessive patch loads.

In general all down loads ("up" with respect to the wing) will be applied to the loading components (tension patches and formers) through a whiffle tree system suspended from the members on the wing. The force will be supplied to this system thru cables by individual hydraulic jacks or jacks and levers. The jacks, levers, and cable pulleys for the system will be attached to a weighted floor structure of steel I beams. The concentrated, or "up" loads, will be applied by jacks and levers supported and reacted by suitable steel stands. Oil supply to all hydraulic cylinders will be maintained and controlled by an electrically driven hydraulic pump located at the central control system.

B. Aft Fuselage and Vertical Tail

1. Fuselage Tests-

Bomb loads, equipment loads and fuselage and tail inertia loads will be applied to the specimen by means of hydraulic rams and levers thru whiffle trees and straps attached to the loading points.

The points of loading will be determined by the type of the load, such as, bombs, equipment, etc. Bomb loads will be applied to the bomb bay trusses thru dummy bomb racks which will pick up the actual bomb rack attaching points. Equipment loads will be applied to the structure in such a manner as to simulate actual equipment installations in so far as is possible and practical. Fuselage and tail inertia loads will be assumed to be beamed to the bulkheads and will be applied to the bulkheads with straps with the proper distribution made to the trusses and to the skin.

2. Vertical Tail Test

The side load on the vertical tail will be applied by means of tension patches and if necessary pressure bags in such a manner as to simulate as nearly as possible the actual pressure and load distribution as determined by stress analysis. The tension patches will be loaded by means of cables or straps and whiffle trees with hydraulic rams and beams supplying the actuating loads.

ANALYSIS
PREPARED BY
CHECKED BY
REVISED BY

Consolidated Vultee Aircraft Corporation
FORT WORTH DIVISION
FORT WORTH, TEXAS

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MODEL Swept Wing B-36
DATE August 17, 1950

B. Aft Fuselage and Vertical Tail - (Continued)

3. Combined Vertical and Horizontal Tail Test

The vertical tail loads will be applied as outlined under (2) above. The horizontal tail loads will be applied to the stub stabilizer and to the fuselage in a manner simulating the horizontal tail loads as determined by stress analysis. These loads will be applied to the test specimen by means of hydraulic rams and beams thru straps attached to the fuselage structure and to the stub stabilizer by means of suitable fixtures.

In general on all tests, the hydraulic pressure gages and loading cylinders will be calibrated, simultaneously, prior to testing. Several check gages will be used in the hydraulic system on the wing test along with tension dynamometers in series with several of the cable systems to provide a check on the accuracy of the applied loads.

STRESS AND DEFLECTION MEASUREMENTS

Sufficient strain readings will be made by SR4 strain gages at critical points of each main structural component to determine the stresses at the applied increments of loading as the test progresses. Beam and torsional deflections will also be measured and recorded at all increments.

CONCLUSIONS

Tests made early in the swept wing program which will prove the structural worthiness of the principal primary structure will expedite the production program of that airplane and preclude the necessity of making expensive design changes on completed airplanes if the original design proves unsatisfactory.

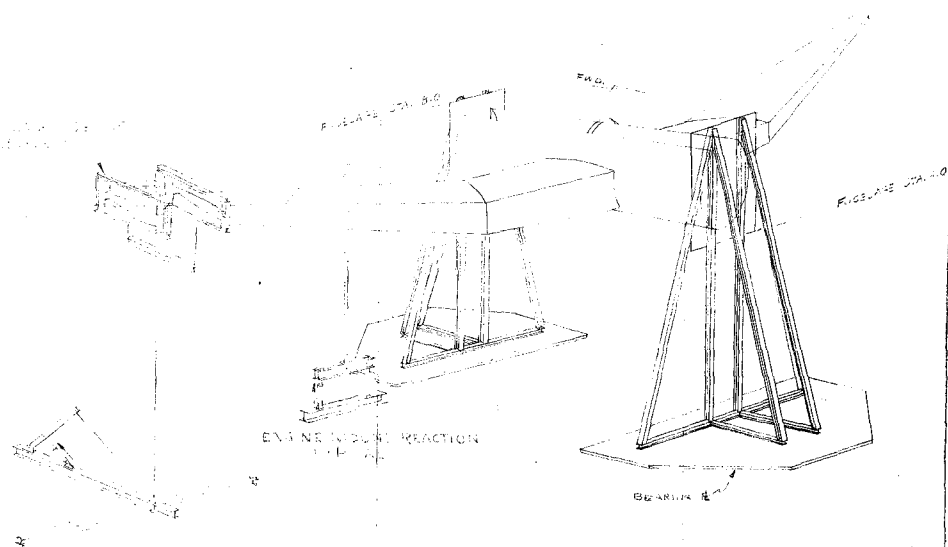


FIGURE 1
GENERAL TEST ARRANGEMENT

GLENN ROCKET

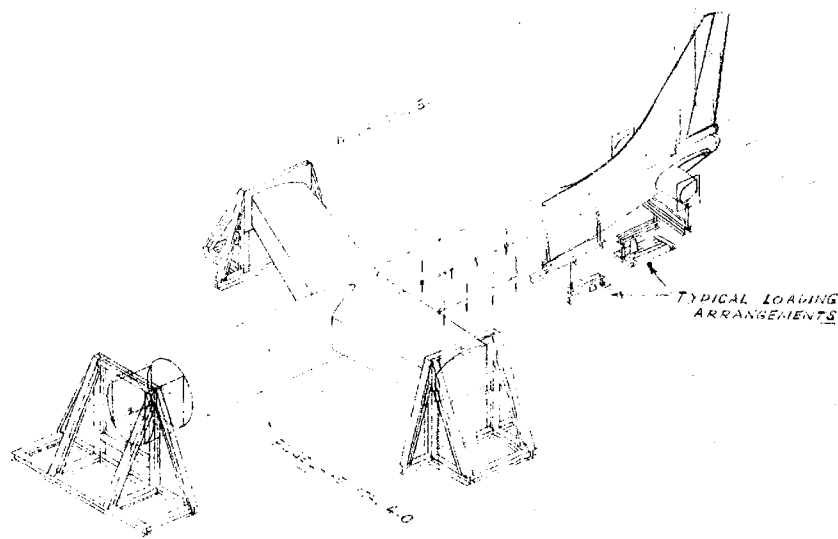


FIGURE NO. 2
+ FUSELAGE +
GENERAL TEST ARRANGEMENT

GLENN L. G. IN. 8-10-50

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WINGS, SWEEP
B-36

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(25) B-36 aircraft

* B-36 aircraft
* Sweep wings

(22) St-42 test